2009

VCE

Further Mathematics

Trial Examination 2

PURPOSE OF THIS TRIAL EXAMINATION
This Further Mathematics Trial Examination is designed to assess

- understanding and communication of mathematical ideas
- interpretation, analysis and solution of routine problems
- interpretation, analysis and solution of non-routine problems

Assessment is by extended answer questions involving multi-stage solutions of increasing complexity.

IMPORTANT COPYRIGHT NOTICE

STUDENT NUMBER

Letter

Figures									
Words									

VICTORIAN CERTIFICATE OF EDUCATION
2009
FURTHER MATHEMATICS

Trial Written Examination 2 (Analysis task)

Reading time: 15 minutes
Total writing time: 1 hour 30 minutes

QUESTION AND ANSWER BOOK

Structure of book
Core

Number of questions	Number of questions to be answered
3	3

Modules

Number of modules	Number of modules to be answered
6	3

•   Students are permitted to bring into the examination room: pens, pencils, highlighters, erasers, sharpeners, rulers, one bound reference, one approved graphics calculator or approved CAS calculator or CAS software and, if desired, one scientific calculator.
Calculator memory DOES NOT need to be cleared.

•   Students are NOT permitted to bring into the examination room: blank sheets of paper and/or white out liquid/tape.

Materials supplied
•   Question and answer book of 34 pages.
•   Working space is provided throughout the book.
•   There is a detachable sheet of miscellaneous formula supplied.

Instructions
•   Detach the formula sheet from the book during reading time.
•   Write your **student number** in the space provided above on this page.
•   All written responses must be in English.

Students are NOT permitted to bring mobile phones and/or any other unauthorised electronic devices into the examination room.

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         http://kilbaha.googlepages.com

FURTHER MATHEMATICS

Written examinations 1 and 2

FORMULA SHEET

Directions to students

Detach this formula sheet during reading time.

This formula sheet is provided for your reference.

Further Mathematics Formulas

Core: Data analysis

standardised score: $\quad z = \dfrac{x - \bar{x}}{s_x}$

least squares line: $\quad y = a + bx$ where $b = r\dfrac{s_y}{s_x}$ and $a = \bar{y} - b\bar{x}$

residual value: $\quad$ residual value = actual value – predicted value

seasonal index: $\quad$ seasonal index $= \dfrac{\text{actual figure}}{\text{deseasonalised figure}}$

Module 1: Number patterns

arithmetic series: $\quad a + (a+d) + ... + (a + (n-1)d) = \dfrac{n}{2}[2a + (n-1)d] = \dfrac{n}{2}(a+l)$

geometric series: $\quad a + ar + ar^2 + ... + ar^{n-1} = \dfrac{a(1 - r^n)}{1 - r}, r \neq 1$

infinite geometric series: $\quad a + ar + ar^2 + ar^3 + ... = \dfrac{a}{1-r}, |r| < 1$

Module 2: Geometry and trigonometry

area of a triangle: $\quad \dfrac{1}{2}bc \sin A$

Heron's formula: $\quad A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \dfrac{1}{2}(a+b+c)$

circumference of a circle: $\quad 2\pi r$

area of a circle: $\quad \pi r^2$

volume of a sphere: $\quad \dfrac{4}{3}\pi r^3$

surface area of a sphere: $\quad 4\pi r^2$

volume of a cone: $\quad \dfrac{1}{3}\pi r^2 h$

volume of a cylinder: $\quad \pi r^2 h$

volume of a prism: $\quad$ area of base $\times$ height

volume of a pyramid: $\quad \dfrac{1}{3}$ area of base $\times$ height

Pythagoras' theorem: $\quad\quad\quad\quad c^2 = a^2 + b^2$

sine rule: $\quad\quad\quad\quad\quad\quad \dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

cosine rule: $\quad\quad\quad\quad\quad c^2 = a^2 + b^2 - 2ab\cos C$

Module 3: Graphs and relations

Straight line graphs

gradient (slope): $\quad\quad\quad\quad m = \dfrac{y_2 - y_1}{x_2 - x_1}$

equation: $\quad\quad\quad\quad\quad\quad y = mx + c$

Module 4: Business-related mathematics

simple interest: $\quad\quad\quad\quad I = \dfrac{\Pr T}{100}$

compound interest: $\quad\quad\quad A = PR^n$ where $R = 1 + \dfrac{r}{100}$

hire purchase: $\quad\quad\quad\quad$ effective rate of interest $\approx \dfrac{2n}{n+1} \times$ flat rate

annuities: $\quad\quad\quad\quad\quad A = PR^n - \dfrac{Q(R^n - 1)}{R - 1}$, where $R = 1 + \dfrac{r}{100}$

Module 5: Networks and decision mathematics

Euler's formula: $\quad\quad\quad\quad v + f = e + 2$

Module 6: Matrices

determinant of a 2×2 matrix: $\quad A = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$; $\det A = \begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$

inverse of a 2×2 matrix: $\quad A^{-1} = \dfrac{1}{\det A} \begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$ where $\det A \neq 0$

END OF FORMULA SHEET

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Specific Instructions

This task paper consists a core and six modules. Students should answer **all** questions in the core and then select **three** modules and answer **all** questions within the modules selected.

Page

Core: Data analysis

Question 1

Levi	Hippo
90	45
100	80
130	75
85	90
74	130
62	135
95	128
140	126
120	114
18	116
12	130
100	100
85	110

The above table shows the hours spent flying in the last month by thirteen stewards from each of two companies, Levi and Hippo.

a.   What percentage of Levi stewards flew for at least 85 hours? Give your answer to one decimal place.

_____

1 mark

b.   What was the standard deviation for the number of flying hours for the Hippo stewards? Give your answer to one decimal place.

_____

1 mark

c.   If the standard deviation for the number of flying hours for the Levi stewards was 38.0 hours, write a sentence describing the difference between the flying hours of the stewards on the two airlines.

_____

_____

_____

1 mark

Core: Data analysis

Question 1 (continued)

d.   Were any of the Hippo flying hours outliers? Give a reason for your answer.

_____

_____

_____

                                                                          1 mark

e.   In the space below, draw the box plot for the number of hours flown by the Hippo
            stewards.

                                                                          1 mark

Levi

Hippo

10   20   30   40   50   60   70   80   90   100   110   120   130   140

Number of Hours Flying Time
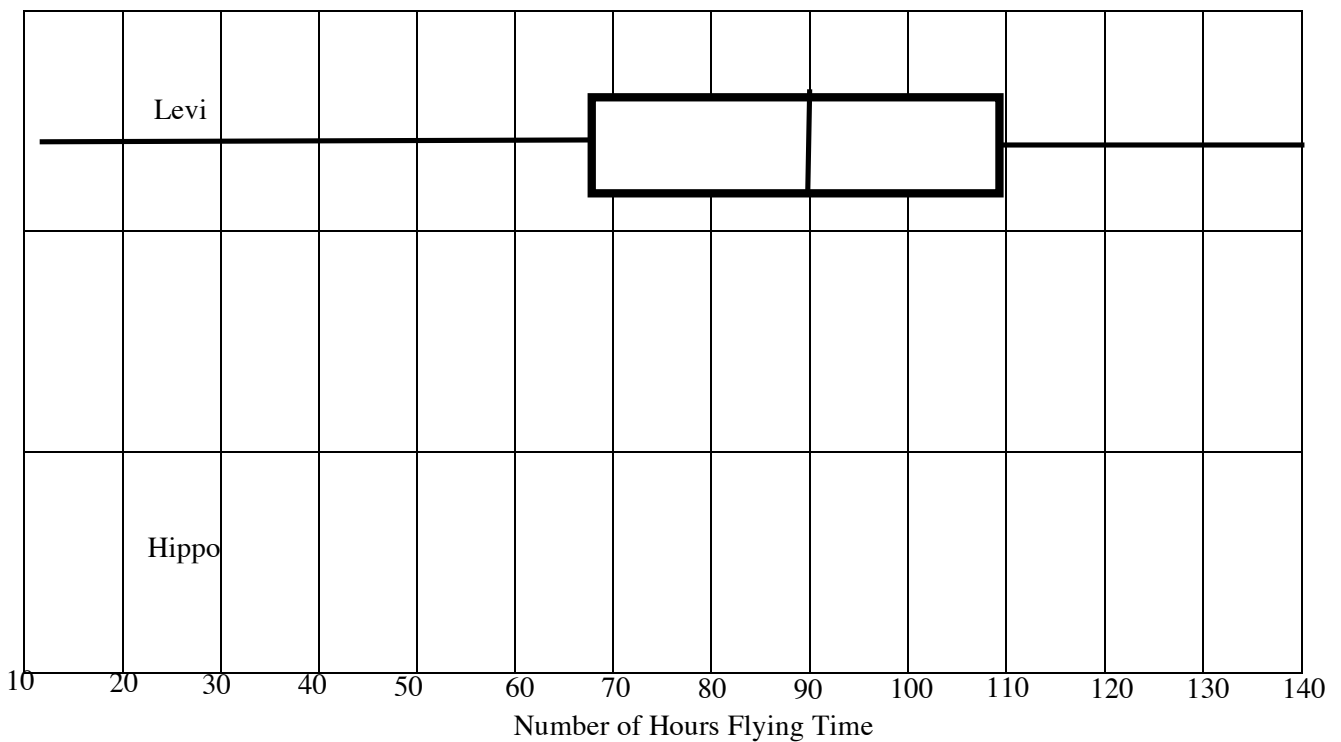
f.   Compare the two box plots with respect to skewness.

_____

_____

_____

                                                                          1 mark

Core: Data analysis

Question 2

The Levi airline company analyses the value of its ticket sales and the amount spent on advertising over a period of time. The results are listed in the table below.

Advertising($)	1000	3000	5000	6000	10000	12000	14000	15000
Sales($)	9000	10000	11000	12500	14500	15000	16000	16500

a. Which is the independent variable?

_____

1 mark

b. Why would it be appropriate to fit a least squares regression line to this data?

_____

1 mark

c. What is the equation of the least squares regression line? Give all values to one decimal place.

$Sales =$ [_____] $+ Advertising \times$ [_____]

1 mark

d. What is the residual value when the advertising is $6000?

_____

_____

1 mark

Core: Data analysis

Question 2 (continued)

e.   What is the value of the coefficient of determination? Give your answer to two decimal
places.

_____

_____

1 mark

f.   What does the coefficient of determination signify in this situation?

_____

1 mark

g.   If the sales figures were $20000, what would you expect the advertising expenditure
to be?

_____

_____

_____

_____

1 mark

Core: Data analysis

Question 3

An airline's sales figures in millions of dollars are listed in the following table.

Season	2005	2006	2007	2008
Summer	150	155	153	156
Autumn	172	170	171	174
Winter	180	181	178	182
Spring	148	149	150	145

a.   What is the seasonal index for Autumn? Give your answer to one decimal place.

_____

_____

_____

                                                                      1 mark

b.   Explain what this seasonal index means in terms of seasonal sales.

_____

_____

                                                                      1 mark

                                                         Total = 15 marks

End of Core: Data analysis

Module 1 : Number patterns and applications

> If you choose this module, all questions are to be answered.

Question 1

The *Acme* mining company decides to mine for copper. In the first year of operation 300 tonnes of copper is extracted and each year thereafter for the next 19 years, production increases by 50 tonnes per year.

a.   How much copper is extracted in the tenth year of operation?

_____

_____

_____

                                                                                                        1 mark

b.   How much copper, t_n, is extracted in the *n*th year of operation where $n < 20$

_____

                                                                                                        1 mark

c.   How much copper has been extracted by the end of the 20 years?

_____

_____

_____

                                                                                                        1 mark

d.   In the 21st year the amount of copper mined, starts to fall by 75 tonnes per year. How much copper is extracted in the 21st year?

_____

_____

_____

                                                                                                        1 mark

Module 1: Number patterns and applications

Question 1(continued)

e.   In what year will the amount of copper extracted first fall below the amount extracted in
the first year?

_____

_____

                                                                                                    1 mark

f.   If they first started extracting copper in the year 2000, then in what year will they cease
extracting copper?

_____

_____

                                                                                                    1 mark

Question 2

The *Beta* mining company starts extracting copper from a mine in another town in the same year
as the *Acme* company begins mining. It mined 800 tonnes of copper in its first year of operation,
but thereafter the output fell by 8.5% per year.

a.   How much copper was extracted in the second year of production?

_____

_____

_____

                                                                                                    1 mark

b.   How much copper does the *Beta* company extract in the first ten years of production?
Give your answer to two decimal places.

_____

_____

_____

                                                                                                    1 mark

Module 1: Number patterns and applications

Question 2(continued)

c.   What is the maximum amount of copper that could be extracted from this mine?
Give your answer to two decimal places.

_____

_____

                                                                                                            1 mark

d.   The managers of the *Beta* company decide to close the copper mine when the annual
production falls below 100 tonnes. In what year of production will they close the mine?

_____

                                                                                                            1 mark

e.   In what year of production will the *Acme* mining company first extract more copper than
the *Beta* company?

_____

                                                                                                            1 mark

f.   How much more copper will the *Acme* company extract than the *Beta* company in the
tenth year of production? Give your answer to two decimal places.

_____

                                                                                                            1 mark

Module 1: Number patterns and applications

Question 3

The profits for the *Acme* mining company increase annually by 15%, after a profit of $250,000 in the first year.

a.   Complete the following difference equation for the profit, P_n, of the *Acme* mining company.

$P_n =$ _____

<div align="right">1 mark</div>

b.   What is the profit for this company in the fifth year of production?

_____

<div align="right">1 mark</div>

c.   In the tenth year of operation, the *Acme* mining company experiences problems in extracting the copper which results in a reduction of their profits by 42.1% for the year. What will the profit be for this year? Give your answer to the nearest dollar.

_____

_____

_____

<div align="right">1 mark</div>

<div align="right">Total = 15 marks</div>

End of Module 1: Number patterns and applications

Module 2: Geometry and trigonometry

> If you choose this module, all questions are to be answered.
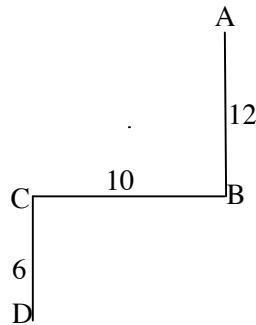
Question 1

To reach a swimming pool, Garry must drive from his home at *A*, due south for 12 km. to B. He then has to travel 10 km. due west to *C* and finally 6 km. due south to the pool.

a.   If it were possible for Garry to travel directly from *A* to *C*, what distance would he have to travel to get to C? Give your answer to two decimal places.

_____

_____

                                                                                                                    1 mark

b.   Find angle *ACD*. Give your answer in degrees to two decimal places.

_____

_____

_____

                                                                                                                    2 marks

c.   Calculate the shortest distance from *A* to *D*. Give your answer to one decimal place.

_____

_____

_____

                                                                                                                    1 mark

Module 2: Geometry and trigonometry

Question 2

A swimming pool is 50 m long and 8 m deep . The maximum depth of water in it is 6 m and this extends for 7 m of the length of the pool. After this, there is a constant decrease in the depth of water, until it reaches a depth of 1 m at the shallow end.

7 m

6 m

1 m

50 m
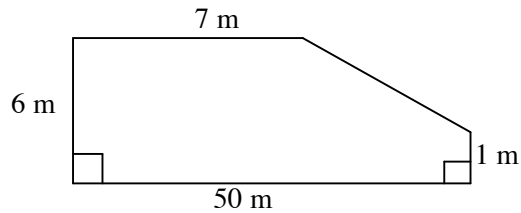
The above diagram shows the side wall of the pool that is covered by water.

a.   Show that the area of this wall covered by water is $192.5\,\mathrm{m}^2$.

_____

_____

_____

_____

_____

1 mark

b.   What is the volume of water in the pool? Give your answer in cubic metres.

_____

_____

1 mark

Module 2: Geometry and trigonometry

Question 2 (continued)

c.   If the whole inside of the pool is to be tiled, what area must be tiled?

_____

_____

_____

<div align="right">1 mark</div>

d.   If each tile covers 300 cm^2, how many tiles would need to be purchased?
           Give your answer to the nearest hundred.

_____

_____

_____

<div align="right">1 mark</div>

e.   Tiles can be bought in packs of 1000 at a cost of $120 a pack. What would be the cost of
           tiling the pool if labour costs are included in the cost of the tiles?

_____

_____

_____

<div align="right">1 mark</div>

f.   What percentage of the tiled area of the pool will be under water?
           Give your answer to one decimal place.

_____

_____

_____

<div align="right">2 marks</div>

Module 2: Geometry and trigonometry

Question 3

Once a year the pool is emptied for cleaning. When the pool is clean, it is refilled from a number of identical tanks using a hose which flows at a rate of $7.5\,\text{m}^3\,/\,\text{min}$

a.   How many hours will it take to refill the pool to its correct depth after it has been
           emptied? Give your answer to one decimal place.

_____

                                                                                                          1 mark

b.   If each of the cylindrical tanks used to fill the swimming pool has a $50\,\text{m}^3$ capacity and a
           height of 4.9 m, what is the diameter of the base of each tank? Give your answer to one
           decimal place.

_____

_____

_____

_____

                                                                                                          1 mark

Module 2: Geometry and trigonometry

Question 4
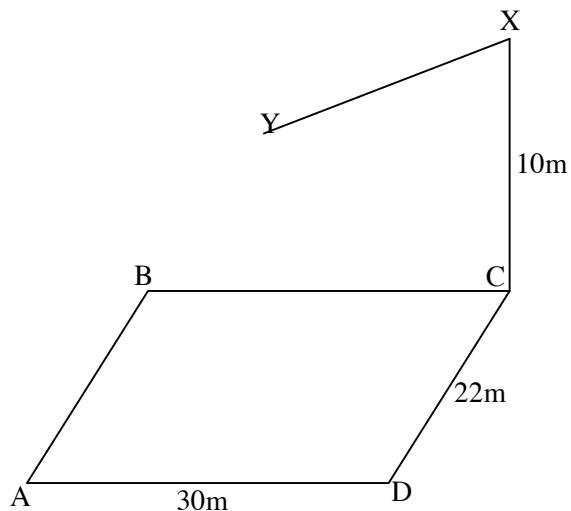
A rectangular diving pool, *ABCD*, has a diving platform, *XY*, where *X* is 10 m above *C* and *Y* is 10 m above the centre of the pool. *AD* is 30 m and *DC* is 22 m.

a.   What is the length of the platform, *XY*? Give your answer to one decimal place.

_____

_____

                                                                                                                1 mark

b.   A diver who is 1.8 m tall stands at *Y* and observes a person 1.5 m tall standing at *A*. What is the angle of depression for the diver? Give your answer to the nearest degree.

_____

_____

_____

_____

                                                                                                                1 mark

                                                                                    Total = 15 marks

End of Module 2: Geometry and trigonometry

Module 3: Graphs and relations

If you choose this module, all questions are to be answered.

Question 1

If a share costs $\$p$, then the commission $\$C$ charged by the stock broker on the sale of 100 of these shares is given by

$$C = \begin{cases} 6 & 1 \le p < 1.5 \\ 3 + 2p & 1.5 \le p < 4 \\ 7 + p & 4 \le p < 24 \\ 19 + 0.5p & 24 \le p < 50 \\ 39 + 0.1p & p \ge 50 \end{cases}$$

a. If the price of a share, $\$p$, is $\$80$, what is the price of 100 shares?

_____

1 mark

b. If 100 shares are sold for $\$75$ per share, what is the commission?

_____

1 mark

c. What is the commission when 100 shares are sold for $\$160$?

_____

_____

_____

1 mark

Module 3: Graphs and relations

Question 1 (continued)

d.   Marcia sells shares in companies where the minimum share price is $10 and the
maximum share price is $50. On the grid below, draw the graph showing Marcia's
commission on 100 shares versus the price of a share.

Commission
for Sale of 100
shares ($)

Cost per Share

_____

_____

_____

_____

_____

_____
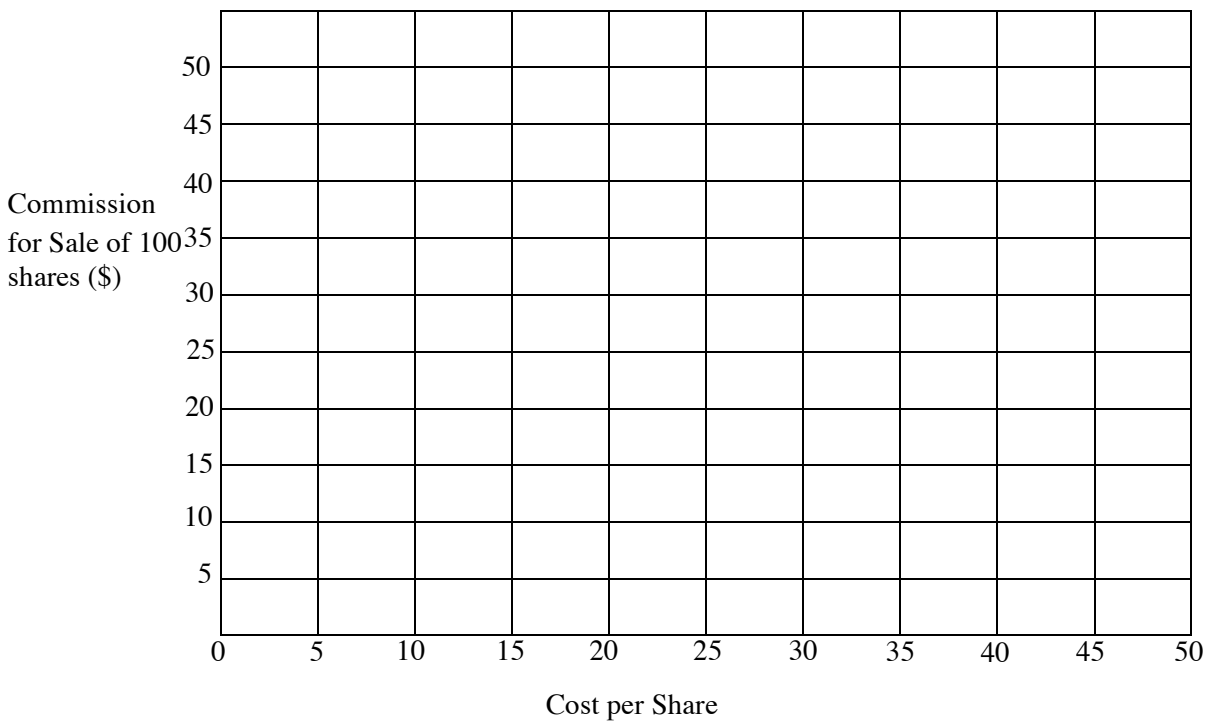
2 marks

Question 2

Each day it costs the owner of the Happy Stitch Company $4245 for heating, lighting, machinery and wages. The company produces x shirts per day and the cost price per shirt is $5.40

a.   Write an equation to show the total daily cost, C, when the company makes x shirts.

_____

                                                                                1 mark

b.   If the shirts sell for $62 each, write an equation for the total daily selling price.

_____

                                                                                1 mark

c.   How many shirts must be made each day to reach the break-even point?

_____

_____

_____

                                                                                1 mark

d.   Write an equation for the daily profit, P, when x shirts are made and sold.

_____

_____

                                                                                1 mark

e.   How many shirts must be made and sold each day if the owner of the company wishes to
         make a daily profit of $25639.80. Assume all shirts made are sold.

_____

_____

                                                                                1 mark

Question 3

The shirt company has two types of machine, *A* and *B*, which it uses to make the shirts. Type *A* is capable of making 200 shirts a day and type *B* can make 300 shirts a day. The producer decides to limit the number of shirts made each day to a maximum of 400, so as not to have a surplus unsold.

a.   If machine *A* makes *x* shirts per day and machine *B* makes *y* shirts per day set up an inequation to show that the total number of shirts made per day cannot exceed 400.

_____

_____

                                                                                    1 mark

b.   The other inequalities are
$$0 \le x \le 200$$
$$0 \le y \le 300$$
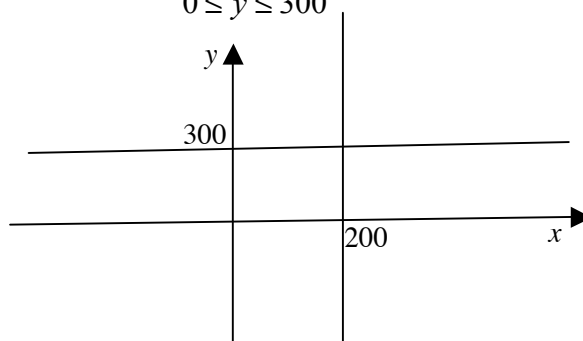
On the graph above, sketch the line representing the inequality you formed in **3 a.**

_____

                                                                                    1 mark

c.   On the graph above, shade the region that satisfies **all** the constraints.

                                                                                    1 mark

Question 3 (continued)

d.   Machine A type makes better quality shirts than machine B type, and so shirts made on machine A are sold for a profit of $52 and shirts made on machine B are sold for a profit of $48.50. Write down an equation for the profit, P, in terms of x and y.

_____

1 mark

e.   What is the maximum profit?

_____

_____

_____

_____

_____

_____

1 mark

Total = 15 marks

End of Module 3: Graphs and relations

Module 4: Business-related mathematics

> If you choose this module, all questions are to be answered.

Question 1

Taxable Income	Tax on this Income
$1 - $6000	Nil
$6001 - $34000	15cents for each $1 over $6000
$34001 - $80000	$4200 plus 30cents for each $1 over $34000
$80001 - $180000	$18000 plus 40cents for each $1 over $80000
$180001 and over	$58000 plus 45cents for each $1 over $180000

The above table shows the tax payable depending on a person's taxable income. Kim runs a landscaping business and her taxable income this year is $88000

a.   How much tax must she pay?

_____

                                                                                                                1 mark

b.   Julie works for Kim and she had a taxable income of $33000 last tax year. This tax year she received an increase of $5000 in her salary. If all of this increase is taxable income,

i.   How much more will she pay in tax this year than last year?

_____

_____

_____

                                                                                                                1 mark

ii.   How much of this $5000 will she actually get to take home after tax?

_____

_____

_____

_____

                                                                                                                1 mark

Module 4: Business-related mathematics

Question 2

Kim charges her client, Rod, $7200 to landscape his front yard. This amount includes 10% G.S.T. Rod agrees to pay a 20% deposit, and then the remainder when the work is finished. He pays the deposit, and then borrows the rest of the money. He makes 4 repayments of $475.20 per year to his money lender for 5 years.

a.   How much deposit does Rod pay?

_____

1 mark

b.   How much G.S.T. must Kim pay to the government for this work? Give your answer to the nearest cent.

_____

_____

1 mark

c.   How much money does Rod repay the money lender?

_____

1 mark

d.   If the interest is charged at a flat rate, what is the interest rate per annum for this loan?

_____

_____

_____

2 marks

Module 4: Business-related mathematics

Question 3

Kim needs to purchase a new car for her business. To do this she takes a reducing balance loan of $25000 at 6.5% per annum. If the interest is calculated monthly and the loan is to be repaid in monthly instalments over 10 years

a.   How much will each monthly repayment need to be?
         Give your answer to the nearest cent.

_____

                                                                                           1 mark

b.   What is the total amount of interest paid over the 10 years?
         Give your answer to the nearest dollar.

_____

_____

                                                                                           1 mark

c.   If after 5 years, Kim can afford to repay $400 per month, how many more years will it
         take for her to repay the loan? Give your answer to one decimal place.

_____

_____

                                                                                           2 marks

Module 4: Business-related mathematics

Question 4

Kim decides to sell her car when its book value reaches $5000. If Kim's $25000 car depreciates at a rate of $0.15 per kilometre

a.   What is the depreciation on the car when it has done 100000 km?

_____

                                                                                                                     1 mark

b.   How many kilometres will the car have done when Kim sells it? Give your answer to the
          nearest kilometre.

_____

_____

_____

                                                                                                                     1mark

c.   If a reducing balance depreciation of 8% per annum is used to depreciate Kim's $25000
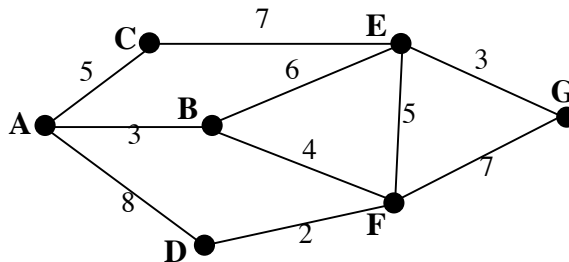   car, how long will it take for the car to be valued at less than $12000?

_____

_____

                                                                                                                     1mark

                                                                                          Total = 15 marks

End of Module 4: Business-related mathematics

Module 5: Networks and decision mathematics

If you choose this module, all questions are to be answered.

Question 1

Samantha and George wish to cycle to each of the seven towns shown as A, B, C, D, E, F and G in the above graph. Samantha says that it is not possible to start at a particular town and finish at that same town, having cycled along each of the roads once.

a.   Explain why Samantha is correct.

_____

_____

                                                                          1 mark

b.   George says that it is possible to start at A and cycle along each road once but that they would finish at a different town. Where would they finish?

_____

                                                                          1 mark

c.   On the graph above, draw in an extra road so that the cyclists could start and finish at the same town and yet visit each of the other towns, having only traveled on each road once.

                                                                          1 mark

Module 5: Networks and decision mathematics

Question 1 (continued)

d.   Maddie has to visit each of the towns to deliver parcels. She wants to travel by the
         shortest possible route. How long is this route if each of the numbers on the network
         represents kilometres, and if it does not matter from which town she starts or where she
         finishes?

1 mark

Module 5: Networks and decision mathematics

Question 2
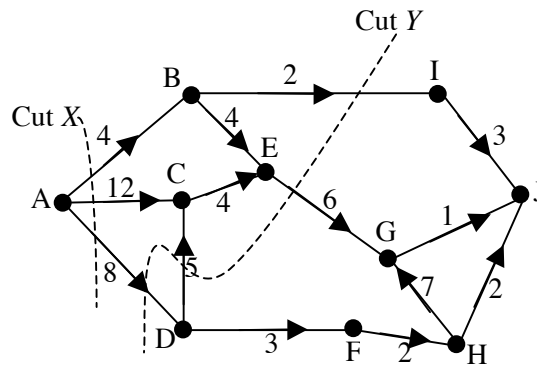
The above network shows the routes flown by an airline company and the number of available seats for each section of the journey. George wishes to fly from A to J

a.   Write down the capacity of

   i.   Cut *X*

_____

                                                                                      1 mark

   ii.   Cut *Y*

_____

                                                                                      1 mark

b.   What is the maximum number of available seats for a flight from A to J?

_____

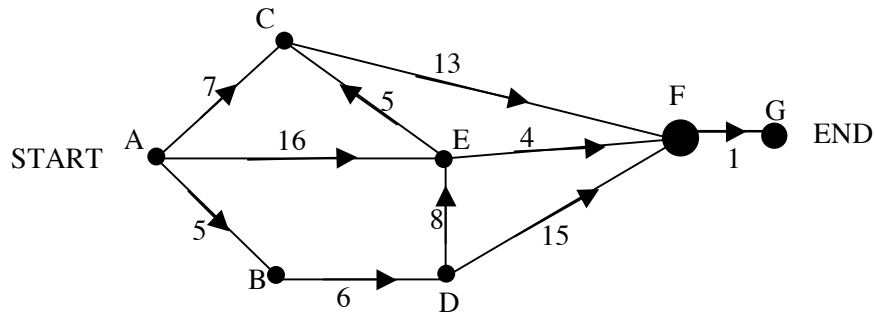   1 mark

c.   On the above network, draw a cut that could be used to help determine the maximum number of available seats from A to J.

                                                                                      1 mark

Module 5: Networks and decision mathematics

Question 3

The above network shows the completion times, in days, for the various activities required to complete the building of an extension.

a. Complete the following table for the above network.

Activity	Immediate Predecessor	Earliest Starting Time (days)
A	None	0
B	A	5
C	A , E	
D	B	11
E	A, D	19
F		

3 marks

b. What is the critical path for this project?

_____

1 mark

c. What is the slack time for activity E?

_____

1 mark

Module 5: Networks and decision mathematics

Question 3 (continued)

d.   Four extra people are brought in to complete activity B, so that the time taken for activity
         B to be completed can be reduced from 6 days to 1 day.

      i.   How much time will be saved on the total project?

_____

_____

<div align="right">1 mark</div>

      ii.   If each day saved on the project saves the builder $1000, but each additional
         worker costs the builder $200 per day, what would your advice be to the builder?

_____

_____

_____

_____

<div align="right">1 mark</div>

<div align="right">Total = 15 marks</div>

End of Module 5: Networks and decision mathematics

Module 6: Matrices

If you choose this module, all questions are to be answered.

Question 1

a. A company produces two products, resistors, R and Pistons, P. If the number of resistors produced is x and the number of pistons produced is y, write a clearly labeled 2×1 matrix to show the number of each type of product produced in terms of x and y.

1 mark

b. During manufacture, each product requires three different parts, a, b and c as shown in the following matrix

$$\begin{array}{c} \\ a \\ b \\ c \end{array}\begin{array}{cc} R & P \\ \begin{bmatrix} 7 & 3 \\ 2 & 5 \\ 4 & 1 \end{bmatrix} \end{array}$$

What is the order of this matrix?

_____

1 mark

c. If the company produces 200 resistors and 120 pistons on one day

    i. Show the matrices and the operation you would use to find the total number of each of the parts a, b and c required.

_____

1 mark

    ii. Find the number of each part required.

_____

1 mark

Module 6: Matrices

Question 2

A shopkeeper buys in bulk, three kinds of dried fruit, raisins, sultanas and currants. She mixes them in various proportions as shown in matrix P, and sells them in kilogram packets called Home Brand, Good Quality and Super Quality

$$
\begin{array}{c}
\\
\\
P = \begin{array}{r}
\text{Home Brand} \\
\text{Good Quality} \\
\text{Super Quality}
\end{array}
\end{array}
\begin{array}{ccc}
\text{Raisins} & \text{Sultanas} & \text{Currants} \\
\left[\begin{array}{ccc}
0.4 & 0.3 & 0.3 \\
0.5 & 0.3 & 0.2 \\
0.4 & 0.2 & 0.4
\end{array} \right]
\end{array}
$$

If the cost of a packet of Home Brand, Good Quality and Super Quality is $4.80, $5.00 and $5.20 respectively,

a. Write a clearly labeled column matrix to show the cost of a kilogram of each type of packet.

_____

1 mark

b Write down, in matrix form, the three linear equations that could be used to find the price per kilogram of each type of dried fruit.

2 marks

c. Solve this matrix equation to find the price per kilogram of each type of dried fruit.

_____

1 mark

Module 6: Matrices

Question 2 (continued)

d. If the proportion of dried fruit in Home Brand is changed in such a way as to give a new matrix Q where

$$Q = \begin{bmatrix} 0.1 & 0.2 & 0.7 \\ 0.5 & 0.3 & 0.2 \\ 0.4 & 0.2 & 0.4 \end{bmatrix}$$

find matrix X such that $Q = X + P$

_____

1 mark

e. What does matrix X tell you?

_____

_____

_____

1 mark

Module 6: Matrices

Question 3

A cheese shop finds that 68% of its weekly shoppers who bought goats cheese in one particular week will buy goats cheese the next week and that 25% of people who did not buy goats cheese in one particular week will buy goats cheese the following week.

a.   Complete the following transition matrix for the cheese shop owner with regard to the purchase of goats cheese.

<div align="center">

This Week

Buy   Not Buy

Next Week

Buy

Not Buy

$$\begin{bmatrix} & \\ & \end{bmatrix}$$

</div>

                                                                                                  1 mark

b.   500 customers bought goats cheese this week and 200 customers
           did not buy goats cheese.

           Construct the initial state matrix, S_0 to describe this

$$S_0 = \begin{bmatrix} & \\ & \end{bmatrix}$$

                                                                                                  1 mark

c.   How many people would be expected to buy goats cheese in three week's time?

_____

_____

                                                                                                  1 mark

Module 6: Matrices

Question 3 (continued)

d.   In the long term, how many would you expect to not buy goats cheese each week?

_____

_____

                                                                    1 mark

e.   The cheese shop owner finds that the transition matrix for the sale of his four most
       popular cheeses is

$$
\begin{array}{c}
\quad \text{Blue}\quad \text{Cheddar}\quad \text{Brie}\quad \text{Gouda} \\
T = \begin{array}{c} \text{Blue} \\ \text{Cheddar} \\ \text{Brie} \\ \text{Gouda} \end{array}
\left[\begin{array}{cccc}
0.3 & 0.1 & 0.2 & 0 \\
0.4 & 0.5 & 0 & 0.1 \\
0.2 & 0.2 & 0.6 & 0 \\
0.1 & 0.2 & 0.2 & 0.9
\end{array} \right]
\end{array}
$$

       If 800 people bought Gouda this week and the ratio of buying Blue, Cheddar, Brie and
       Gouda last week was 1:3:2:1, then what was the total number of people who bought these
       four cheeses last week?

_____

_____

_____

_____

                                                                    1 mark

                                                      Total = 15 marks

                           End of Module 6: Matrices

                       END OF QUESTION AND ANSWER BOOK
                  2009 Further Mathematics Trial Examination 2